WRC-95 to undertake the necessary feasibility studies within the ITU-R to allocate the extended MSS uplink band at 2010-2025 MHz to global MSS at WRC-97; or determine other, more suitable spectrum for MSS.

Finally, the Commission should issue an Order in the instant NPRM by the end of 1995 to allocate the bands 1990-2010 MHz and 2170-2200 MHz for MSS global services to become available for use beginning in 1998 as existing BAS operations are cleared from these bands pursuant to the Phase One and Two rechannelization program. The Order should indicate that the Commission will entertain applications for MSS systems at 2 GHz as soon as possible.

B. Phase Two: Implementation of the MSS Band Extensions

Phase Two encompasses the various steps necessary in this domestic proceeding and at WRC-95 and WRC-97 to identify and allocate additional spectrum for global MSS systems to provide a total allocation of 35 Mhz of spectrum in each direction for global MSS. Our preference, from an operational and cost standpoint, is for the Commission to pursue its proposed MSS uplink band extensions at 2010-2025 MHz. Alternatively, if WRC-95 and/or WRC-97 determines that other more suitable spectrum should be employed for MSS band extensions, the Commission in Phase Two would pursue those bands for future use by global MSS systems.[13]

As a first step under Phase Two, and based upon the decisions at WRC-95, the Commission and the MSS industry should actively

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[13]Because of the uncertainty concerning the outcome of the U.S. proposals for MSS extension bands, it may be necessary as part of Phase Two for the Commission to issue a further NPRM in this proceeding to allocate those bands which the world community agrees upon for MSS system expansion.

participate in studies within the ITU-R to determine the feasibility and arrangements to allocate the extended bands 2010-2025 MHz and 2165-2170 MHz to global MSS at WRC-97. Consistent with this effort, the U.S. should develop proposals to allocate this spectrum to global MSS at WRC-97.

As a second step, depending upon the decision at WRC-97 -- and assuming the band 2010-2025 MHz is allocated for global MSS uplink spectrum -- the Commission should require BAS/ENG to commence the transition to digital transmission to be completed by the year 2005 when the new global band for MSS becomes available. Because of the increased spectrum efficiency from digital operations, we believe that BAS/ENG could operate effectively in the remaining BAS allocations at 2025-2110 MHz. As part of this transition, the first BAS channel would be reduced to 13 MHz of bandwidth, while the other six BAS channels would utilize 12 MHz of bandwidth. Given the latest developments in broadcast technology, both in direct-to-home technology and with advanced digital television, we are convinced that the broadcast industry will be highly motivated to move to a digital format, as much for the economic and social gains, as well as for the increased spectrum efficiency.[14] Indeed, we note that the Commission,

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[14]Currently Satellite News Gathering ("SNG") operations are changing over to a digital format to take advantage of the spectral efficiency afforded by the use of digital techniques. COMSAT has recently completed development of an MPEG II compatible digital TV codec and modem combination. This unit can provide "contribution quality" video with associated audios in a 6 MHz bandwidth with a robustly encoded, high-level modulation signal that provides a quality signal in a minimum bandwidth. This unit currently sells for $ 60,000 per unit. The matching receiver sells for $ 3000 per unit. Given competitive forces in this field, it is expected that these prices will come down by a

at the direction of the Chairman, is already considering ways to ensure that broadcasters make effective use of digital technology.[15]

As a final step in Phase Two, and subject to the results of WRC-97, the Commission should allocate the new global MSS bands at 2010-2025 MHz and 2165-2170 MHz in the United States. This allocation would be made in a second Order to be released in this proceeding which would contain the Commission's rules for transitioning existing BAS/ENG operations to a reduced channel assignment in the 2025-2110 MHz band by the year 2005, as described above.

If our two-phased plan works as envisioned, the Commission's proposal in the NPRM to allocate 35 MHz of spectrum in each direction to global MSS in the uplink bands at 1990-2025 MHz and the downlink bands at 2165-2200 MHz will be accomplished in an economically viable and technically feasible manner, with full international cooperation, and within a time frame that accommodates the needs of the various parties to this proceeding. Such a result will accommodate the spectrum demands of multiple global MSS systems and will promote the

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factor of 2 to 4 within the next five years.

The move to digital technology, through increased spectral efficiency, will provide an increased number of channels for ENG. With the use of digital technology, it will be easily possible to provide "contribution quality" transmission for Advanced TV, as proposed by the Grand Alliance, of signals in bandwidths less than 12 MHz. Thus, the rechannelization scheme proposed here by COMSAT will enable a channel capacity equal to the current capacity for Advanced TV transmission (7 channels x 12 MHz) and a doubling of capacity for the transmission of conventional TV (6 channels x 14 Mhz), while allowing an expansion in MSS spectrum utilization.

[15]See Jessell, "Hundt: No free (digital) lunch," Broadcasting (Apr. 10, 1995).

public interest in a robust, competitive global MSS marketplace.[16] Thus, we respectfully urge the Commission to give careful consideration to our alternative plan.

VI. AUCTIONS ARE NOT APPROPRIATE FOR AWARDING GLOBAL MSS LICENSES

In the NPRM, the Commission gives "advance notice" of its intent to award MSS licenses for 2 GHz by competitive bidding. NPRM at para. 17. Such action seems premature, particularly when the Commission has yet to adopt a final allocation scheme for MSS at 2 GHz. Moreover, the Commission has an affirmative obligation under the Communications Act to avoid mutual exclusivity in licensing wherever feasible. Consequently, we believe the Commission should focus its efforts at this time on devising appropriate sharing strategies to accommodate multiple 2 GHz MSS licenses and avoid mutual exclusivity altogether.

Even if mutual exclusivity exists, the use of auctions to award licenses for globally allocated spectrum does not promote the public interest in a robust, competitive global MSS market. Auction payments, which would be in addition to any relocation expenses, would increase the costs to MSS service providers, and ultimately increase prices to the consumer. Moreover, the use of auctions in the United States is drawing much attention in many countries around the world who could decide to follow the U.S. lead and hold their own auctions for use of globally allocated spectrum. Such a result, we believe, would be cost prohibitive, such that no global system would be viable;

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[16] In COMSAT's Application for Authority to Participate in the Procurement of Facilities for the I-CO System, filed, May 1, 1995, with the International Bureau, we noted that the I-CO system operating at full capacity will utilize a maximum of 8-10 MHz in each direction in any one continental-sized region.

and would discourage, rather than promote, the development of competitive global mobile satellite services. Also, the opportunity to abuse the auction process is real and could be used to discriminate among potential systems and act as a barrier to entry.

A. The FCC Should Strive to Avoid Mutual Exclusivity in Licensing Decisions

Sections 309(j)(1) and (2) of the Communications Act, as amended, 47 U.S.C. S 309(j)(1),(2), give the Commission the authority to conduct auctions to choose among "mutually exclusive" applications for initial licenses where the principal use of the spectrum is reasonably likely to involve compensation by subscribers for the service.[17] However, as a further section of the Act makes clear, the Commission's ability to use auctions does not relieve it of its primary obligation "in the public interest...to avoid mutual exclusivity in application and licensing proceedings." See 47 U.S.C. S 309(j)(6)(E).

As the legislative history indicates, Section 309(j)(6)of the Act "requires the Commission to continue to use engineering solutions, negotiation, threshold qualifications, service regulations, and other means in order to avoid mutual exclusivity." (emphasis added) H.R. Rep. NO. 103-213, 103rd Cong. 2nd Sess, at 485. This statement reflects the view of both Houses on the Conference Agreement which enacted the competitive bidding legislation. An earlier House Report states that the Commission is "encourage[d]...to avoid mutually

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[17]In general, the Commission considers two or more applications to be mutually exclusive if grant of one application would effectively preclude, by causing harmful electrical interference, the grant of one or more of the other applications. Second Report and Order, PP Docket No. 93-253, 9 FCC Rcd 2348,2350 (1994) ("Auction Order").

exclusive situations, as it is in the public interest to do so." See H.R. Rep. No.103-111, 103rd Cong. 1st Sess., at 258. The House Report goes on to state that the "Big LEO" MSS proceeding is a case in point where the Commission has endeavored to avoid mutually exclusive licensing situations through the use of spectrum sharing arrangements and the creation of specific threshold qualifications, including service criteria. The Report concludes "[t]hese tools should continue to be used when feasible and appropriate." Id. at 258-259.

Given the explicit language in the Act and the clear intent of Congress to avoid mutual exclusivity in the first instance, we do not think the Commission should rush to employ auctions in this proceeding, particularly in light of the fact that the final spectrum allocation for 2 GHz MSS has yet to be made and the Commission has yet to devise any other rules for MSS licensing or service criteria. In the Big LEO proceeding the Commission explored every opportunity, and was finally able, to devise a sharing plan which would accommodate multiple MSS licensees in the 1.6/2.4 GHz bands and to adopt stringent threshold qualifications in order to avoid mutual exclusivity.[18] Although auctions may be available to award Big LEO licenses as a last resort, the specter of auctions appears to be intended to encourage the applicants to settle their differences and not to be used as a primary licensing scheme. See id. at 5963, 5967.

As we have demonstrated above, COMSAT firmly believes that there are alternative engineering solutions for the global 2 GHz MSS bands

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[18]Report and Order, CC Docket No. 92-166, 9 FCC Rcd 5936, 5954-5963 (1994) ("Big LEO Order").

which will permit multiple MSS licensees to utilize the 2 GHz MSS bands allocated at WARC-92 and new MSS band extensions which may be allocated at a future Conference. Such technical, spectrum sharing solutions should help to avoid mutual exclusivity in the 2 GHz MSS band. We would also propose that the Commission consider threshold qualifications and service criteria which would ensure that the 2 Ghz bands are utilized first by those service providers which are truly prepared to make use of the spectrum to bring new services to the marketplace. In light of our proposals, and the strong statutory mandate to avoid mutual exclusivity, we believe the Commission in this proceeding should concentrate on allocating the spectrum in a manner which will accommodate multiple 2 GHz MSS licenses and eliminate the prospect for mutual exclusivity.

B. Using Auctions to Award Global MSS Licenses at 2 GHz Does Not Promote the Public Interest

The Commission has indicated that there is a strong public interest in encouraging the development of competitive global MSS systems. NPRM at para. 7. It has also indicated that the use of auctions with global MSS systems raises concerns that are not applicable to domestic-only services and may have unintended consequences internationally.[19] In particular, the Commission has expressed the concern that, in imposing auctions on global MSS providers in the United States, other countries may follow the U.S. example and impose these costs on global MSS providers elsewhere. Given the number of other countries that may be served by global MSS

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[19]Notice of Proposed Rulemaking, CC Docket No. 92-166, 9 FCC Rcd 1094, 1117 (1994).

systems, the Commission has acknowledged that auction costs for global MSS may be considerable and may preclude a U.S.-owned system from serving other countries. Id.

Notwithstanding these potential problems, the Commission in the Big LEO proceeding chose to adopt auctions as a potential licensing method for mutually exclusive MSS systems operating in the 1.6/2.4 GHz bands. Big LEO Order at 5971-5972. In discounting its own concerns for the international consequences of auctions, and the concerns expressed by all of the Big LEO applicants and by COMSAT, the Commission indicated that there was "no concrete evidence" of such harmful effects. Id. at para. 83. Moreover, the Commission noted that, even if auctions were implemented in foreign countries, it believed applicants would pay no more for these licenses than the amount which they determined was economically feasible. Id. at para. 84. As COMSAT will show, neither conclusion is correct and, thus, we urge the Commission to adopt a different result in this proceeding.

To begin with, many other countries have expressed concern about the prospect of the United States imposing auctions on global MSS licenses. CEPT has filed Comments in this proceeding indicating its belief that if such action were to be repeated around the world "it would jeopardize the commercial feasibility of new MSS systems and the realization of truly global services." Comments of CEPT, ET Docket No. 95-18, filed March 2, 1995. In addition, the Russian Federation has recently submitted a document to the ITU-Development Sector, Study Group 2, proposing that the group study the questions of spectrum pricing and the use of auctions to grant authorizations for frequency

management systems.[20]

In addition, we fail to see how a global MSS provider "would pay no more than economically feasible" for a particular MSS market when at the time of bidding the applicant has no knowledge of the total number of markets it will have to bid on! In contrast to the domestic PCS auctions, for which the Commission utilized the same type of auction method that it has proposed in this proceeding, it is impossible to estimate the number of separate market segments within an international market or to devise a "simultaneous multiple round bidding" strategy when the various sub-markets may not be going to auction at the same time.[21] Administrations will be transitioning to MSS at 2 GHz at different times depending on their current deployment of fixed services in the 2 GHz band. Consequently, it may be difficult to estimate accurately the necessary up front capital investment to participate in the various auctions that may be held around the world.

Moreover, the costs of having to purchase entrance rights around the world to global MSS markets, coupled with the expense of relocating existing systems in the 2 GHz band, will drive the cost of operating an international MSS system at 2 GHz to a point which could well compromise economic feasibility and deter the creation of a competitive global MSS market. In contrast to applicants for 2 GHz

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[20]See Doc. 2/6, ITU-D Study Group 2, submitted March 30, 1995.

[21]In addition, bidders will not know what auction procedures will be used in other countries, and, in fact, the procedures used may be much less fair and efficient than those the Commission would adopt.

global MSS spectrum, Big LEO applicants did not face the prospect of having to pay to clear their bands of significant numbers of existing service providers. Indeed, none of the three Big LEOs licensed so far in the United States has had to pay for its license at auction. Given this economic advantage for Big LEO MSS systems, we fail to see how the Commission would ensure a level playing field -- or bidding strategy -- for competitive global MSS systems operating at 2 GHz in the United States, much less in international markets.

COMSAT also is concerned that the Commission's rush to implement auctions, and its success in raising billions of dollars with PCS, may cause it to loose sight of other, important communications policy objectives. Under Section 309(j)(7) of the Act, the Commission must ensure that important communications policy objectives are not sacrificed in the interest of maximizing revenues from auctions. See 47 U.S.C. s 309(j)(7); H.R. Rep. No. 103-111 at 585. In this context, it is important for the Commission not to overlook U.S. policies governing the establishment of a global information infrastructure ("GII") and the creation of open and competitive global communications markets.

The Administration's GII policy is based on five principles including the promotion of competition and the creation of a flexible regulatory environment. In furthering these principles, governments are encouraged to remove barriers to competition in telecommunications and to establish transparency of regulations and charges.[22] We fail to

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[22]GII: Agenda for Cooperation, U.S. Dept. of Commerce at 13-17 (Feb. 1995) ("GII Agenda").

see how these goals can be achieved if some countries decide to auction global satellite spectrum and others do not. Auctions increase the cost of doing business in a given country, and if costs become prohibitive, then many service providers will elect not to do business there. Moreover, in many countries auctions may serve as an effective barrier to entry. In such a situation, the benefits of global MSS in serving remote areas and helping to unify the global village will be lost.[23]

Finally, an even greater concern is that the auctioning of national frequency assignments by the United States could impact the international allocation process or the orbital location process administered by the ITU. There have been longstanding debates in the ITU over the issue of international allotments for the spectrum/orbital resource.[24] Indeed, CEPT, in its Comments in this proceeding has noted its concern that national auctions are "contrary to the spirit of the ITU Constitution." See CEPT Comments at 2. Implementation of the auction concept nationally, thus, could lead to efforts to adopt auctions at the international level -- a proposal which the United States would surely oppose.

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[23]In addition, at a time when the Commission is seeking to open foreign markets to U.S. service providers and to permit greater foreign participation in U.S. communications markets, it would be counter-productive for the Commission to raise barriers to market entry in the United States by imposing auctions on global MSS licenses.

[24]See, e.g., Comments filed In the Matter of Columbia Communications Corp., Petition for Declaratory Ruling With Respect to Coordination and Interconnection With the Proposed Tongasat Satellite System, FCC File No. ISP-94-014.

COMSAT urges the Commission to carefully consider the significant impact auctions will have on the establishment of a competitive global MSS market and on international communications policies and procedures as it proceeds with the instant rule making. COMSAT firmly believes that these international concerns merit the Commission's refraining from using auctions to award global MSS licenses at 2 GHz.

VII. OTHER TECHNICAL ISSUES RAISED IN THE NPRM

In the NPRM, the Commission asks for comment on a number of other technical matters related to its proposal for the 2 GHz band. NPRM at para. 16. In particular, the Commission requests comment on: whether it should limit the proposed new MSS bands to either exclusive geostationary orbit ("GSO") or low earth orbit ("LEO") use; whether minimum geographic coverage requirements or a particular access method, such as CDMA, should be adopted; what power limits should be imposed; and whether there is a need to allocate spectrum for feeder links to support 2 GHz MSS. We will comment on each of these issues in turn.

A. Orbital Configurations for 2 GHz MSS Systems

To begin with, COMSAT believes that the new MSS bands should not be limited to a particular orbital configuration. As we noted in our comments in the Big LEO proceeding, there is no technological or other reason to believe that the services and benefits offered by MSS satellite technology will be unique to particular orbits. COMSAT Comments, CC Docket No. 92-166, filed May 5, 1994. Today, the Inmarsat system provides global coverage (except polar regions) to mobile maritime, land and aeronautical users, using a configuration of

4 primary GSO satellites, two primary Atlantic satellites and one each for the Indian and Pacific Oceans, plus spare satellites. Future global MSS systems will use various satellite orbital designs, including low-earth orbits (e.g. Iridium and Globalstar), intermediate orbits (e.g. I-CO and Odyssey) and elliptical orbits (e.g. Ellipsat). Also, ITU's Radiocommunication Bureau has received advanced publication information or requests for coordination from administrations for a mixture of GSO and non-GSO satellites (including the United States).[25]

While the total number of satellites needed to provide global coverage and the individual satellite characteristics and operating parameters will differ depending upon the orbital altitude and inclination used, these differences will be largely transparent to the consumer. Moreover, as with any satellite, the different MSS systems will have to comply with the required international radio regulation and domestic coordination rules to avoid harmful interference to existing services and to one another. For these reasons, COMSAT believes that the Commission should not limit use of the 2 GHz MSS band to a particular type of satellite technology or specific orbital parameters.

B. Geographic Coverage Areas and Access Methods

Nor do we believe that there is any technical or other reason to limit use of the 2 GHz band to a particular system architecture, such as code division multiple access ("CDMA") or time division multiple

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[25]See CPM Doc. 95/4-E, January 2, 1995, and Addendum 1 to Doc. CPM 95/4-E, from Director, Radiocommunications Bureau, 28 March 1995.

access ("TDMA"). We note that in the Big LEO proceeding the Commission accommodated both types of access methods in devising a spectrum sharing plan for the 1.6/2.4 GHz bands. Big LEO Order at 5954-5961. The same MSS service providers are interested in using the 2 GHz band for their second generation systems and other, first generation MSS systems are being planned for this band, including Celsat which proposes to use CDMA architecture and I-CO P which will employ a TDMA access methodology. We believe that a sharing plan, similar to that devised for the Big LEOs, can be created for the 2 GHz MSS band to accommodate the different access methods employed by the various 2 GHz MSS service providers.

We agree with the Commission that it may be useful to implement minimum geographic coverage requirements for the 2 GHz band. As the Commission noted in the Big LEO Order, such requirements further the creation of a global information infrastructure and ensure that the benefits of MSS technology reach remote, populated areas of the world where even basic communications services remain scarce today. See Big LEO Order at 5947. The minimum geographic coverage rule adopted in the Big LEO proceeding specifies that the proposed system be capable of providing MSS to "all locations as far north as 70° latitude and as far south as 55° latitude for at least 75% of every 24-hour period." See 47 C.F.R. S 25.143(b)(2)(ii). We believe that the coverage requirement adopted in the Big LEO proceeding is an effective means to provide global coverage and contain system costs. Accordingly, we believe that a similar rule could be adopted in this proceeding for use with global MSS systems operating at 2 GHz.

C. Power Limits for 2 GHz MSS

The Commission's request for comment on the power limits that could be adopted for 2 GHz MSS systems presumes that power limits could be imposed either on MES transmissions in the MSS uplink band or on emissions from satellites in the MSS downlink band. While power limits may be appropriate for MSS downlinks, there is no reason to limit the power from MES handsets, except to the extent necessary to meet existing RF hazard guidelines for handheld transmitters.

Power density limits for certain MSS uplinks were established at WARC-92 under the special provisions of RR 731E. This footnote was devised to protect GLONASS, a satellite-based aeronautical radionavigation system from interference caused by MSS uplinks in the 1610-1626.5 MHz band. As there are no allocations for aeronautical radionavigation in the 1980-2010 MHz MSS frequency range, however, there is no need to impose EIRP density limits for MESs in the 2 GHz uplink bands. In making this assertion, we are assuming that PES transmit power densities and EIRP are commensurate with handheld terminals.

As we demonstrate in Appendix 2, in the MSS downlink band, fixed systems can share the 2170-2200 MHz MSS allocations on a co-primary basis. Thus, there may be a need to provide power flux density ("pfd") limits at the earth surface in order to limit the amount of interference into fixed station receiving systems operating in that band. The ITU-R has been addressing this need.

Studies have been carried out within the ITU-R over the last several years, involving MSS systems operating in either 2483.5-2500

MHz and/or 2170-2200 MHz portions of the 2 GHz bands, and sharing with FS in those frequency ranges. The conclusion is that sharing between non-GSO/MSS downlinks and certain existing FS is feasible. See CPM95 Report, at 26 These sharing studies have led to a preliminary draft new Recommendation for pfd values to protect terrestrial systems from MSS downlinks. See Task Group 2/2 Doc. 2-2/TEMP89 (Rev. 1). The Recommendation specifies both pfd values and fractional degradation of performance ("FPD") percentage values. These values are to be used as coordination threshold or "trigger" values between non-GSO/MSS (space-to-earth) and FS systems in the 2 GHz bands. FPD is limited to values not exceeding 25% for the 2170-2200 MHz bands.

However, if the Commission considers there is a need to impose a pfd limit, COMSAT's preference is that the 2 GHz bands evolve to a point where no pfd limits are required, as in the 1.5/1/6 GHz MSS bands today. COMSAT recommends that the coordination pfd values be used within the United States only as a starting point, on a trial basis. Coordination threshold pfd values, are designed to be very sensitive in order to "catch" all downlinks, even those which have negligible impact to FS. Thus, these limits are not really appropriate for "absolute" pfd limits. However, in the future, detailed coordination, or actual measurements, would provide the Commission with an operational value, or absolute pfd, which will guarantee FS their desired performance level without being overly restrictive to MSS.

D. Feeder Link Spectrum

Finally, in regards to the need to allocate feeder link spectrum for 2 GHz MSS, we note that this issue is already under consideration in ITU Task Groups 8/3 and 4/5 and that the conclusions to feeder link studies have been summarized in the WRC-95 CPM Report. See CPM 95 at 38-68. One of the primary goals of WRC-95 is to identify and allocate spectrum for MSS feeder links that are needed by gateway earth stations to communicate with non-geostationary satellites operating in the MSS service link bands. Because feeder links are transmitted from received fixed earth station locations, selected frequency bands allocated to the FSS are candidate bands for MSS feeder links with appropriate sharing conditions to protect FSS satellite systems in geostationary orbit. At the WRC-95 CPM , it was noted that 200-400 MHz of spectrum in each direction, in each of the 4-8 GHz and 8-16 GHz frequency ranges was needed to accommodate new MSS system feeder link requirements. We agree with these conclusions and believe that WRC-95 will utilize these studies as the technical basis for international decisions regarding feeder links and amendments to the Article 8 International Table of Allocations in the Radio Regulations. Consequently, we suggest that the Commission propose to allow 2 GHz MSS licensees to operate in any FSS bands which are allocated internationally for MSS feeder links at WRC-95, or at future subsequent world radio conferences.

VIII. CONCLUSION

For the foregoing reasons, COMSAT requests that the Commission adopt the proposals and recommendations advanced by COMSAT in these Comments on the NPRM to allocate spectrum at 2 GHz for global MSS systems.

Respectfully Submitted,

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May 5, 1995

Table 1 - Total U.S. Fixed Service Assignments

Band	Service	1991(1)	1992(2)	1993(2)	1994(3)
1850-1990 MHz	POF	9,358	8,977	8,634	
1990-2110 MHz	BAS	1,536	1,796	1,696	
2110-2130/2160-2180 MHz	CC	6,329	6,277	8,371	9,218
2130-2150/2180-2200 MHz	POF	13,455	13,205	13,001	11,120
3.7-4.2 GHz	CC	33,174	28,861	24,892	
5.925-6.425 GHz	CC/POF	18,679	25,294	29,731	
6.525-6.875 GHz	POF	16,557	16,178	16,437	
10.55-10.68 GHz	CC/POF	893	749	1,446	
10.7-11.7 GHz	CC/POF	7,609	9,500	8	

POF - Private Operational Fixed
BAS - Broadcast Auxiliary Service
CC - Common Carrier

(1) 1991 Data obtained from Robert J. Matheson, F. Kenneth Steele. *Preliminary Look at Spectrum Requirements for the Fixed Services.* U.S. Department of Commerce, Institute for Telecomunication Sciences, May 1993.
(2) Updated 1992-1993 Data obtained from NTIA ITS STAFF (Robert J. Matheson)
(3) Updated 1994 Data obtained from Comsearch/Columbia Spectrum Management (Tom Lusk)

Figure 1

FCC's Proposed Re-allocation of 2 GHz Bands

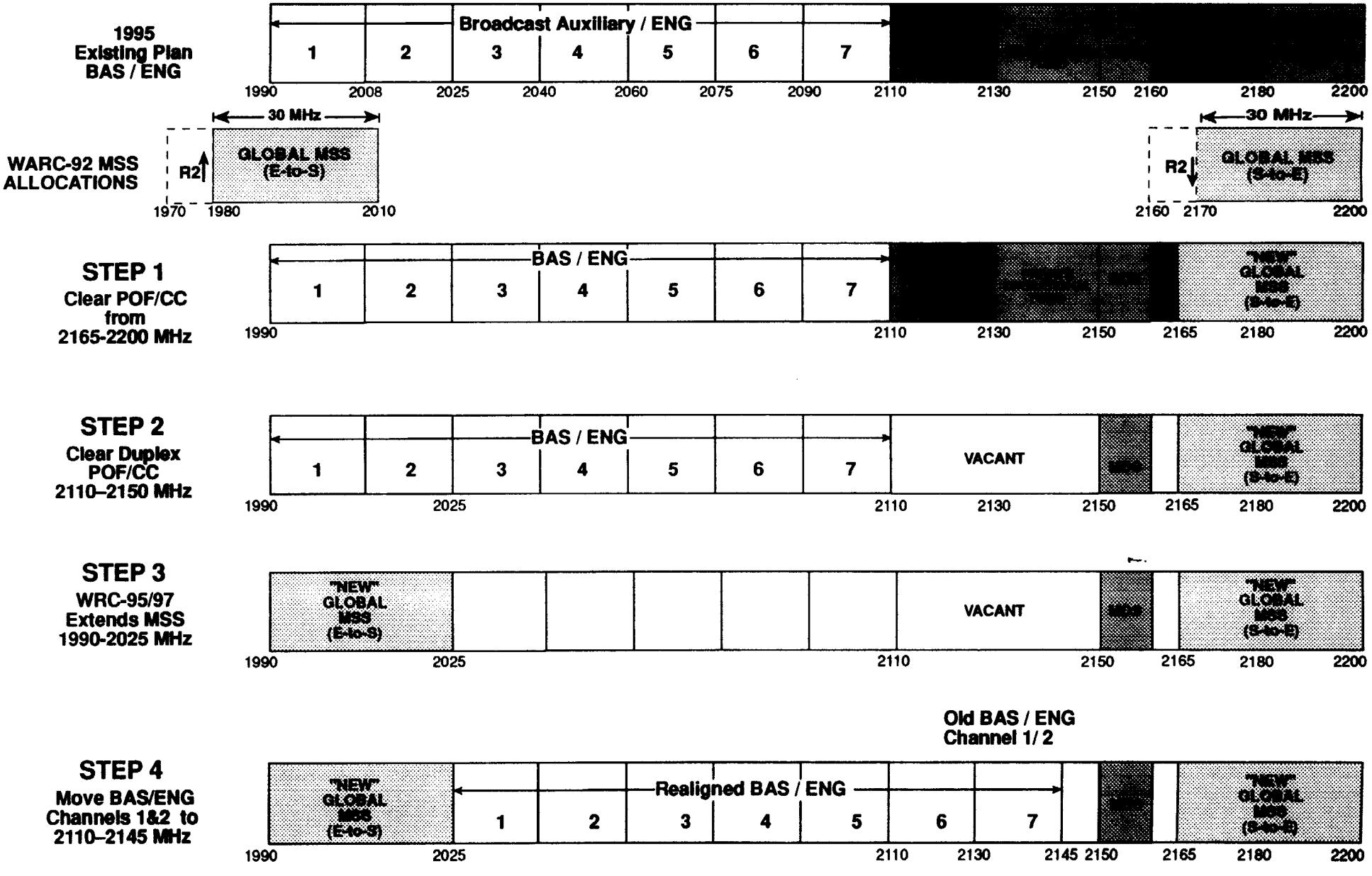
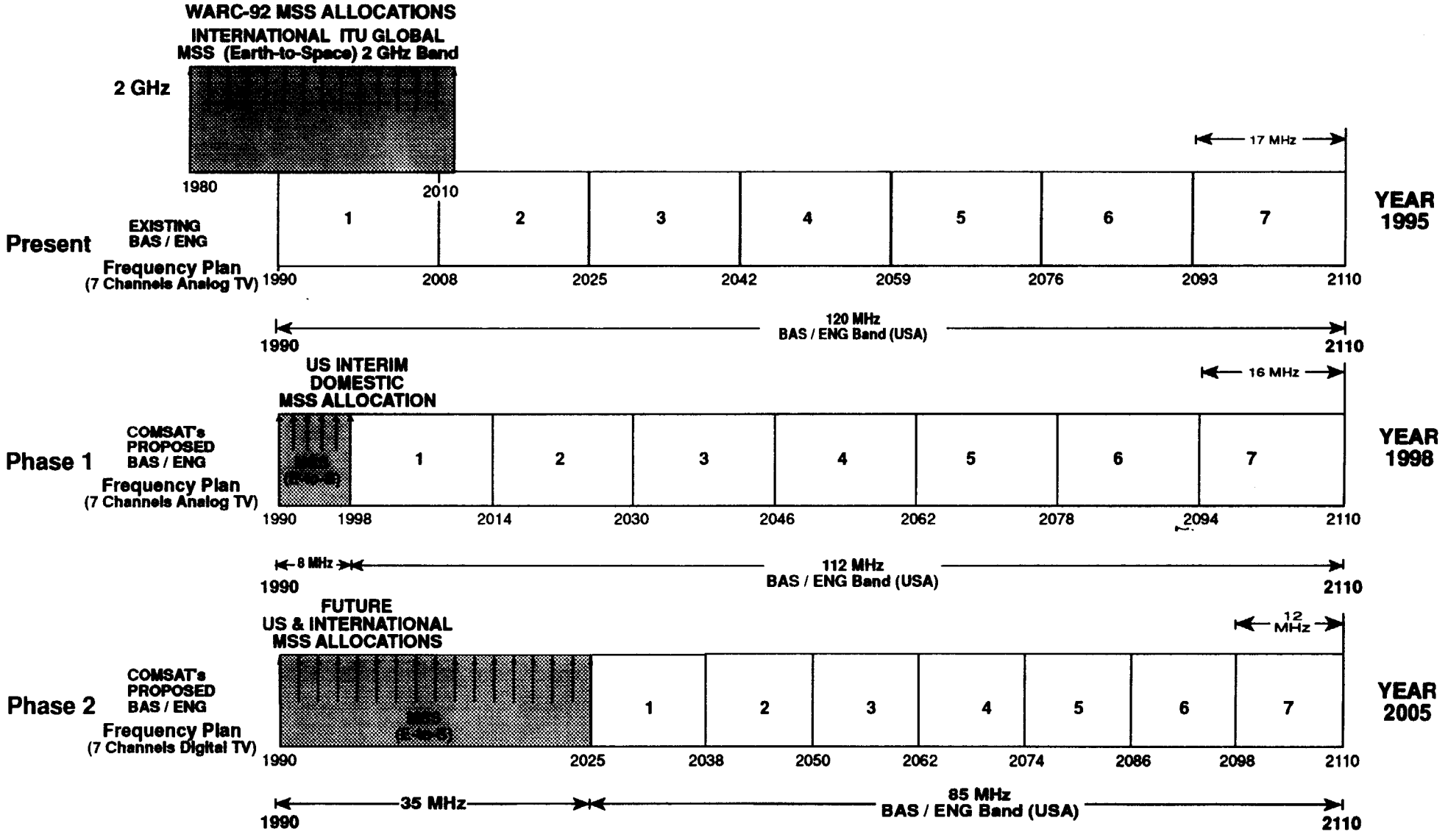


Figure 2

COMSAT's Proposed Rechannelization of the BAS 2 GHz Band



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APPENDIX I

SIMULATION OF INTERFERENCE BETWEEN TRANSMITTERS OF THE BROADCAST AUXILIARY SERVICE AND INTERMEDIATE CIRCULAR ORBIT SPACECRAFT OPERATING IN THE MOBILE SATELLITE SERVICE

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SIMULATION OF INTERFERENCE BETWEEN TRANSMITTERS OF THE BROADCAST AUXILIARY SERVICE AND INTERMEDIATE CIRCULAR ORBIT SPACECRAFT OPERATING IN THE MOBILE SATELLITE SERVICE

Introduction

COMSAT Mobile Communications (CMC) is acutely aware of the potential for interference between terrestrial stations operating in the Broadcast Auxiliary Service (BAS) and spacecraft operating in the Mobile Satellite Service (MSS) in portions of the bands currently jointly allocated to both Services. DoPEStically CMC is an active participant in the FCC Industry Advisory Committee on WRC '95 and its associated Informal Working Groups (IWGs) which are dealing with these important interference issues.

Based upon this participation, CMC has conducted studies of the effects of interference and the possibilities for sharing frequency bands between the MSS and the BAS. CMC has determined that frequency sharing is not possible between transmitting stations operating in the BAS and receiving spacecraft operating in the MSS and has performed computer simulations to confirm this allegation. The purpose of this Appendix is to describe the work performed by CMC, explain the conclusions reached in the execution of that work and substantiate the frequency sharing conclusions.

Description of Simulation

A computer simulation effort was mounted in order to determine the effects of interference from BAS terrestrial transmitters on a receiving I-CO spacecraft operating in the MSS. Briefly, the simulation program assumes a configuration of BAS transmitting stations and a constellation of receiving MSS spacecraft and evaluates the amount of interference received by each MSS spacecraft as a function of time.

Current frequency allocations based on WARC'92 grant co-primary status to the BAS and the MSS Earth-to-space in the 1990 - 2010 MHz band. As MSS spacecraft must use sensitive receivers in order to provide service to low power handheld earth terminals, relatively powerful transmitters operating in the BAS represent a significant interference source to these spacecraft. The computer simulation was used to assess this interference threat.

The BAS is utilized primarily for Electronic News Gathering (ENG) and as such the transmitters are portable and may be directed in any orientation in order to provide the best transmission quality between a late breaking news event and one

of several fixed receiving sites. To model the interference environment, the computer program randomly establishes the location of a number of BAS transmitters based upon a number of transmitters per given area in the USA. In this case the transmitter density was one transmitter per 2200 square miles. Transmitting azimuths are chosen at random and all of the transmitters are assumed to be directed at the horizon and have a 0° elevation angle. The characteristics of the transmitters are given in the next section.

The I-CO satellites are assumed to be in a specific set of orbits and form a constellation, in this case, 10 satellites in two orbital planes each inclined 45° from the equator. As opposed to Geostationary spacecraft, which appear from the earth's surface to remain stationary, spacecraft in an ICO will move across the sky in a set pattern. As the spacecraft move across the sky their various spotbeams will be irradiated by the terrestrial BAS. The relevant baseline spacecraft parameters are summarized as follows:

# of Satellite Planes	2
# of satellites per plane	5
Orbit Height	10355 km
Orbit Inclination	45°
# of transmitting beams	121
Boresight Separation	3.96°
Allocated Bandwidth	25 kHz
Occupied Bandwidth	22.5 kHz
EIRP per Carrier	36.2 dBW
Maximum # of Carriers/Beam	80
Center Frequency of all Beams	1990 MHz

After the generation of the BAS transmitter locations, the simulation program calculated the interference into each spacecraft receiver as the MSS spacecraft constellation progressed across the sky. Interference calculations were made for each MSS satellite receiver for a simulated time interval of 20 seconds for a total for 4320 intervals, which simulated one day of operation. This period of time is sufficient to evaluate the interference for stations in the USA since it covers the passage of at least four satellites over the country.

The output of the simulation is a record of the Carrier-to-Interference plus Noise ratio (C/N+I) for the MSS receiving spacecraft. This quantity is arrived at by establishing a reference MSS link using one Personal Earth Station (PES). In the simulation program, 12 PESs are active at one time. The program determines which PES is in the appropriate service area and then determines which satellite beam is servicing this link. Once the beam is determined, the amount of BAS interference impinging on that beam is calculated. The simulation assumes a distribution of BAS transmitters spread over a geographical area and further assumes that only one third of these transmitters are active at any given time. Once the level of interference in known, the C/I is computed directly. The C/N is computed by determining the noise power at the spacecraft receiver from the input bandwidth of the spacecraft and the noise temperature of the spacecraft receiver. Combining the C/I and the C/N on a power basis results in the C/(N+I). The C/(N+I) results are presented in the next section.

Results of UPLINK Simulations: ENG Transmitters into MSS Uplinks

COMSAT used the simulation software described above to determine the aggregate effects of interference from a number of ENG-mobile van transmitters--those which would be "visible" to satellites/beams carrying handheld links--into the MSS (receiving system) uplinks. Specifically, we entered into the simulation model the uplink parameters of the I-CO Non-GSO/MSS satellite network and ran these parameters against the typical RF characteristics of the ENG mobile van stations. The simulation of the resulting C/(I+N) statistics were generated for twelve (12),separate reference I-CO Personal Earth stations (PESs) or handheld terminals, being used at various locations around the world. The parameters for ENG transmit stations and the I-CO uplink receiving system, respectively, are listed below:

ELECTRONIC NEWS GATHERING (ENG) TRANSMIT STATIONS

EIRP	33 dBW; 1432 ENG Stations active simultaneously
Peak Gain	21 dBi; beamwidth = 15 degrees baseline
Gain pattern	ITU-R Rec. 699-2 radiation pattern (roll-off)
FM/TV RF Bandwidth	17 MHz (Carson Rule Bandwidth)